Idaho National Engineering and Environmental Laboratory

Sacramento Small Scale Liquefier Plant

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NGVTF Technical Committee Meeting January 28-29, 2003

CRADA Participants

PG&E

DOE-OHVT

Southern California Gas

California Energy Commission

INEEL

Sacramento Liquefier

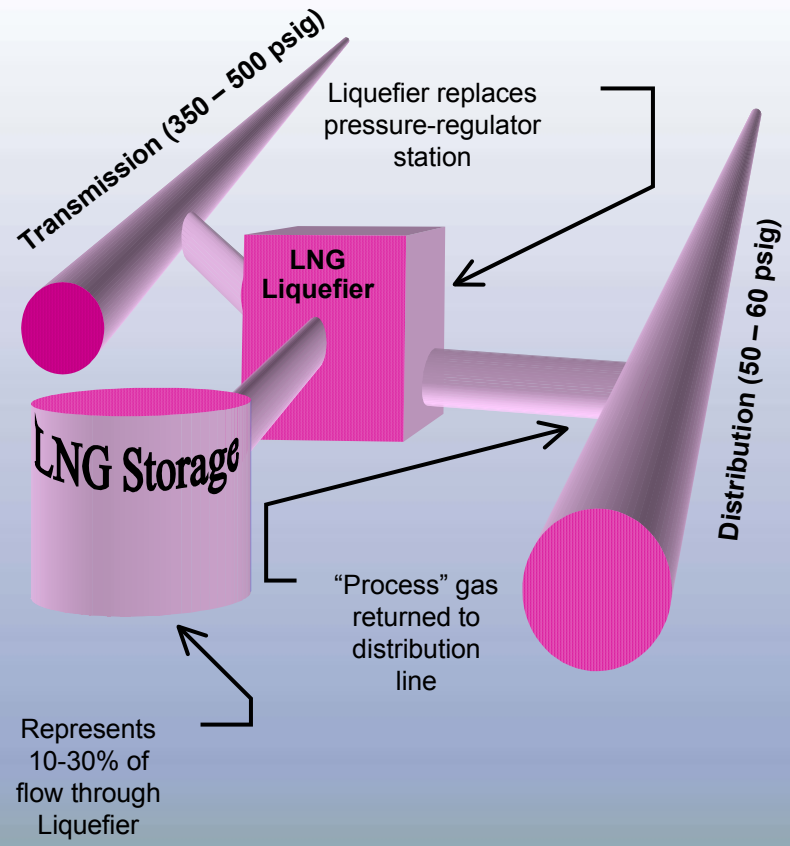
- Started March 2000
- Research and development project
- Pipeline based liquefier
- Comparable with large plants (difficult to do)
- Objectives to control/reduce costs
  - Operating
  - Maintenance
  - Capital Equipment

Development Strategy

- *Utilize pipeline pressure as motive force for liquefying*
- *Incorporate CO_2 and H_2O clean up as part of the process rather than pre-processing activities*
- *Design the process to keep ethane and propane concentrations low to prevent enrichment*
- *Design the plant in a way that it was technically and economically viable*

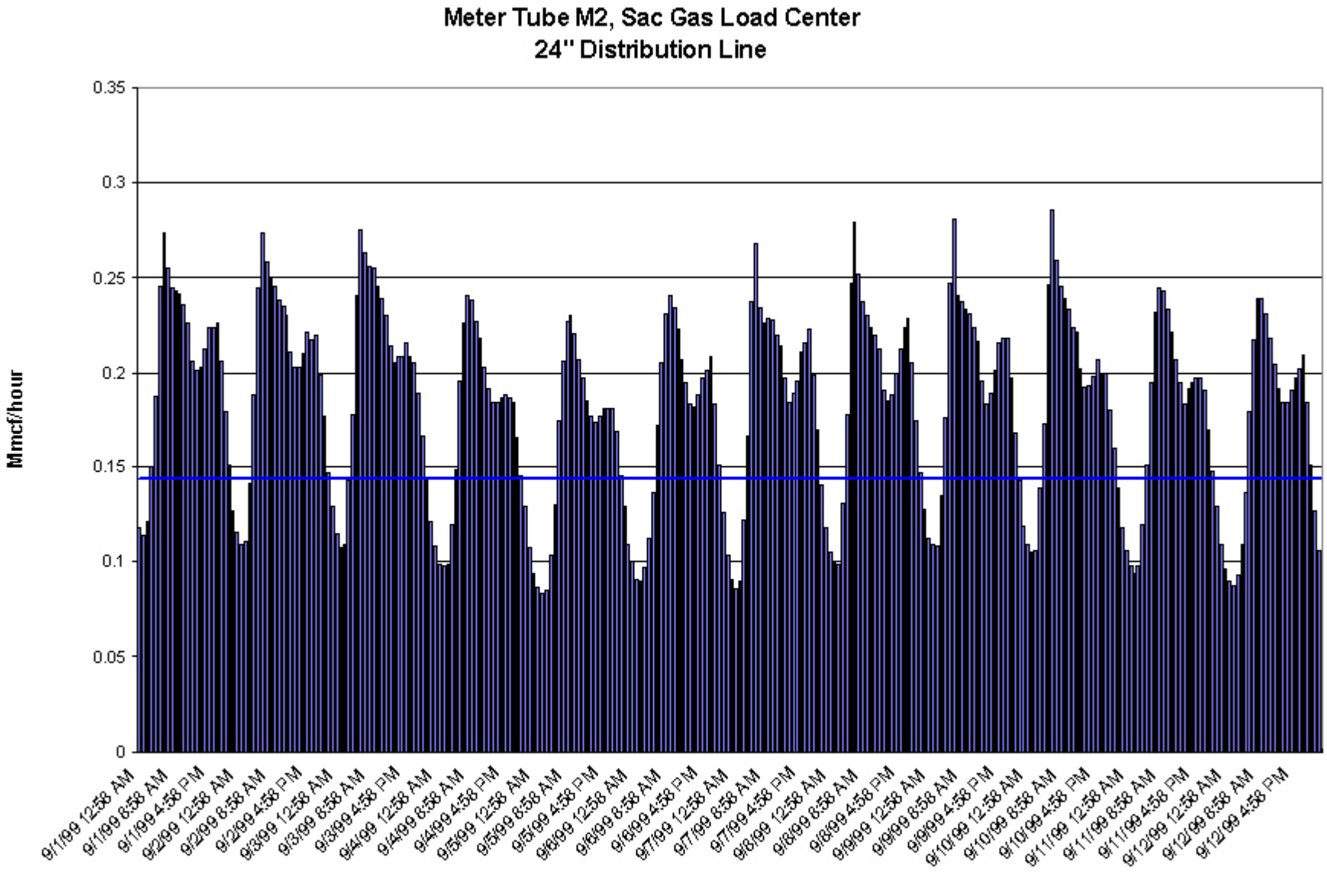
Using the "Energy" in Pipelines

- Pressure letdown from transmission to distribution represents "wasted" energy.
- Energy can be "re-captured" with turbo-expander inserted in place of the pressure-regulator station.
- "Re-captured" energy drives the turbo-expander to create pressure and temperature differentials needed to liquefy a portion of the natural gas stream.
- LNG production efficiency depends on pressure differential, gas composition and total gas throughput.



Technical and Economical Viability

- *Easy to permit in an urban environment*
- *Cost of LNG to be competitive with gasoline and diesel*
- *Provide value to pipeline owners (LDC's)*
  - *Sell gas*
  - *Extend their customer base*
  - *Management tool for pipeline flow capacity*
  - *Backup for service interruption*
  - *Manage infrastructure growth*
  - *Economic return for plant owners*


Meter Tube M2, Sac Gas Load Center
24" Distribution Line
Mmcf/hour
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
9/1/99 12:58 AM
9/1/99 8:58 AM
9/1/99 4:58 PM
9/2/99 12:58 AM
9/2/99 8:58 AM
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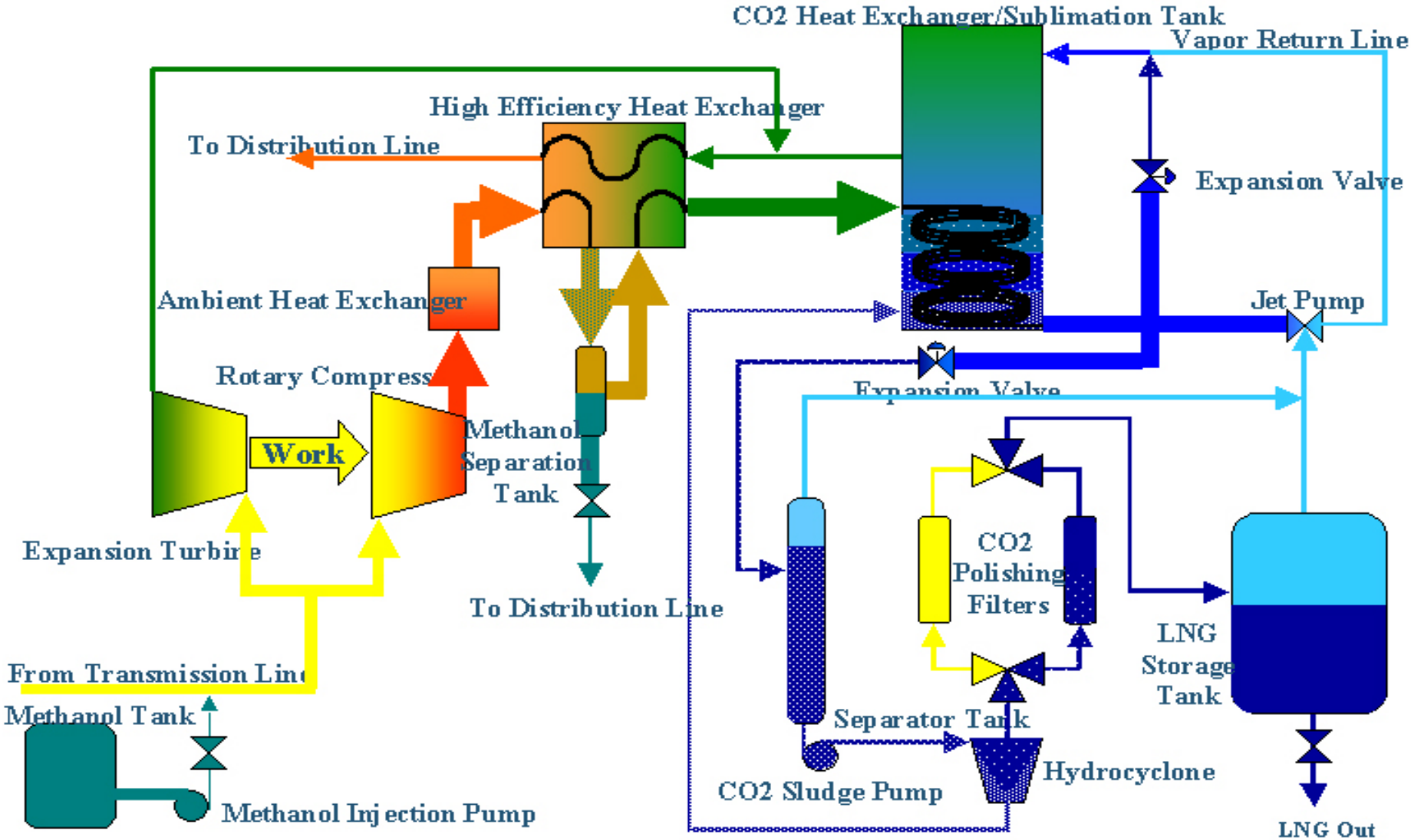
Small Scale Natural Gas Liquefaction




Clean Fuels

Research and Development Status

- *Installation completed in July 2002*
- *Initial testing started*
- *Liquid successfully produced*
- *CO_2 removal system not tested*
- *Several issues with vendor supplied equipment*
  - *Turboexpander*
  - *Liquid pump*

Next Steps

- *Equipment Repairs underway*
- *Other system modifications underway*
- *Testing expected to continue in February*
- *Operation thus far has been in a manual mode*
- *Automatic control software tested*
- *System optimization and testing*
- *License technology to industry*